

**VERIFYING AND CALIBRATING
UNIT WEIGHT MEASURES
AASHTO T 121**

1.0 SCOPE

- 1.1 This method covers the procedure for checking the critical dimensions of a unit weight measure and calculating the volume of the measure, for the explicit use of measuring unit weight only.
- 1.2 When a measuring bowl for an air meter is used for unit weight determination, it shall conform to the requirements of AASHTO T 152 and shall be calibrated for volume as described in T 19

2.0 REFERENCES

- 2.1 AASHTO Standards
 - M 231 Weighing Devices Used in the Testing of Materials
 - T 19 Unit Weight and Voids in Aggregate
 - T 121 Mass per Cubic Meter (Cubic Foot), Yield, and Air Content (Gravimetric) of Concrete

3.0 APPARATUS

- 3.1 Balance, M 231, Class G5, readable to 1 gram with accuracy to 2 grams or 0.1% of the sample weight
- 3.2 Feeler Gauge, capable of measuring to 0.25 mm
- 3.3 Two glass plates, a minimum of 6 mm thick with a length and width at least 25 mm greater than the diameter of the unit weight measure.
- 3.4 Ruler, readable to 1.0 mm
- 3.5 Thermometer, readable to 0.1°C with a range of 15°C to 30°C
- 3.6 Vernier calipers, readable to 0.01 mm

4.0 PROCEDURE - VERIFICATION

- 4.1 Set the measure on top of one glass plate
- 4.2 Using the ruler, determine the following dimensions of the measure:
 - 1. Interior height
 - 2. Exterior height
 - 3. Outside diameter at mid-height
 - 4. Inside diameter at the top
- 4.3 Using the calipers, measure the wall thickness at the top
- 4.4 Place the second glass plate on top of the measure with the same orientation as the first.
- 4.5 Measure the distance between the plates on opposite sides along a center line of the measure.
- 4.6 Measure the width of the top glass plate at one point along the center line
- 4.7 Using the feeler gauge, attempt to insert the gauge between the glass plate and the rim

5.0 PROCEDURE - MEASURE VOLUME

- 5.1 Set out measure and sufficient clean tap water in appropriate container and allow measure water to acclimate to room temperature
- 5.2 Apply film of grease to top rim of measure
- 5.3 Weigh the measure and one glass plate
- 5.4 Fill the measure with water at room temperature and cover with the glass plate in such a way as to eliminate bubbles and excess water
- 5.5 Weigh the measure, glass plate, and water
- 5.6 Remove glass plate and determine the temperature of the water
- 5.7 Determine the density of water from attached table
- 5.8 Calculate the volume of the measure to four significant figures (0.000)
- 5.9 Determine factor for measure by taking the inverse of the volume to four significant figures (0.0000)
- 5.10 Use permanent marker to record the volume (V) and factor (F) on the outside of the measuring bowl in English units

6.0 TOLERANCES

- 6.1 The dimension tolerances for the measure shall meet the following requirements:

REQUIREMENTS FOR MEASURES			
Capacity of Measure *	THICKNESS OF METAL		
	Bottom	Upper 38 mm of Wall	Remainder of Wall
m ³	mm	mm	mm
0.006	5.0	2.5	2.5
0.011	5.0	5.0	3.0
0.014	5.0	5.0	3.0

* Capacity (m³) = 3.14 (radius(m))² (height (m))

- 6.2 The height of the measure shall be greater than 80 percent and less than 150 percent of the diameter of the measure.
- 6.3 The slope between pieces of plate glass in contact with the top and bottom shall not exceed 0.87 percent in any direction.
- 6.4 The top rim shall be smooth and plane within 0.25 mm.

UNIT WEIGHT MEASURE OF CONCRETE VERIFICATION AASHTO T 121

Measure Identification: _____

DIMENSIONS	
A. Interior height (mm)	
B. Exterior height (mm)	
Bottom thickness = B-A (mm)	
Wall thickness at the top (mm)	
C. Outside diameter at mid height (mm)	
D. Inside diameter at the top (mm)	
Wall thickness below 38 mm = 0.5 (C-D) mm	
Height / Diameter (%) = B / C (100)	
Capacity (m ³) = 3.14 (D/2) ² (A) x 10 ⁹	

PLANENESS	
E. Distance between plates on side one (mm)	
F. Distance between plates on side two (mm)	
G. Width of top plate (mm)	
Slope (%) = [(E-G) - (F-G)] / G x 100	
Does the feeler gauge pass between the plate and rim?	

Remarks:

Verified by: _____

Date: _____ Next due date: _____

UNIT WEIGHT MEASURE OF CONCRETE CALIBRATION AASHTO T 19

Measure Identification: _____

MEASUREMENTS	
A. Weight of measure and glass plate (g)	
B. Weight of measure, glass plate, and water (g)	
C. Weight of Water = B - A (g)	
D. Temperature of Water (°C)	
E. Density of Water (kg/m ³)	

$$\text{Volume (V)} = \frac{\text{Weight of Water}}{\text{Density of Water}} = \frac{\text{C}}{\text{E} \times 1000} \times 35.315 \frac{\text{ft}^3}{\text{m}^3} = \boxed{} \text{ ft}^3$$

$$\text{Measure Factor (F)} = \frac{\text{Density of Water}}{\text{Weight of Water}} = \frac{1}{V} = \boxed{}$$

Remarks:

Calibrated by: _____

Date: _____

Next due date: _____

Temp °F	Density lb/ft3	Temp °F	Density lb/ft3	Temp °F	Density lb/ft3	Temp °F	Density lb/ft3	Temp °F	Density lb/ft3	Temp °F	Density lb/ft3	Temp °F	Density lb/ft3	Temp °F	Density lb/ft3	Temp °F	Density lb/ft3
60.0	62.3660	63.0	62.3480	66.0	62.3290	69.0	62.3080	72.0	62.2850	75.0	62.2610	78.0	62.2340	81.0	62.2060	84.0	62.1760
60.1	62.3654	63.1	62.3474	66.1	62.3283	69.1	62.3073	72.1	62.2842	75.1	62.2601	78.1	62.2331	81.1	62.2050	84.1	62.1750
60.2	62.3648	63.2	62.3468	66.2	62.3276	69.2	62.3066	72.2	62.2834	75.2	62.2592	78.2	62.2322	81.2	62.2040	84.2	62.1740
60.3	62.3642	63.3	62.3462	66.3	62.3269	69.3	62.3059	72.3	62.2826	75.3	62.2583	78.3	62.2313	81.3	62.2030	84.3	62.1730
60.4	62.3636	63.4	62.3456	66.4	62.3262	69.4	62.3052	72.4	62.2818	75.4	62.2574	78.4	62.2304	81.4	62.2020	84.4	62.1720
60.5	62.3630	63.5	62.3450	66.5	62.3255	69.5	62.3045	72.5	62.2810	75.5	62.2565	78.5	62.2295	81.5	62.2010	84.5	62.1710
60.6	62.3624	63.6	62.3444	66.6	62.3248	69.6	62.3038	72.6	62.2802	75.6	62.2556	78.6	62.2286	81.6	62.2000	84.6	62.1700
60.7	62.3618	63.7	62.3438	66.7	62.3241	69.7	62.3031	72.7	62.2794	75.7	62.2547	78.7	62.2277	81.7	62.1990	84.7	62.1690
60.8	62.3612	63.8	62.3432	66.8	62.3234	69.8	62.3024	72.8	62.2786	75.8	62.2538	78.8	62.2268	81.8	62.1980	84.8	62.1680
60.9	62.3606	63.9	62.3426	66.9	62.3227	69.9	62.3017	72.9	62.2778	75.9	62.2529	78.9	62.2259	81.9	62.1970	84.9	62.1670
61.0	62.3600	64.0	62.3420	67.0	62.3220	70.0	62.3010	73.0	62.2770	76.0	62.2520	79.0	62.2250	82.0	62.1960	85.0	62.1660
61.1	62.3594	64.1	62.3414	67.1	62.3213	70.1	62.3002	73.1	62.2762	76.1	62.2511	79.1	62.2241	82.1	62.1950	85.1	62.1649
61.2	62.3588	64.2	62.3408	67.2	62.3206	70.2	62.2994	73.2	62.2754	76.2	62.2502	79.2	62.2232	82.2	62.1940	85.2	62.1638
61.3	62.3582	64.3	62.3402	67.3	62.3199	70.3	62.2986	73.3	62.2746	76.3	62.2493	79.3	62.2223	82.3	62.1930	85.3	62.1627
61.4	62.3576	64.4	62.3396	67.4	62.3192	70.4	62.2978	73.4	62.2738	76.4	62.2484	79.4	62.2214	82.4	62.1920	85.4	62.1616
61.5	62.3570	64.5	62.3390	67.5	62.3185	70.5	62.2970	73.5	62.2730	76.5	62.2475	79.5	62.2205	82.5	62.1910	85.5	62.1605
61.6	62.3564	64.6	62.3384	67.6	62.3178	70.6	62.2962	73.6	62.2722	76.6	62.2466	79.6	62.2196	82.6	62.1900	85.6	62.1594
61.7	62.3558	64.7	62.3378	67.7	62.3171	70.7	62.2954	73.7	62.2714	76.7	62.2457	79.7	62.2187	82.7	62.1890	85.7	62.1583
61.8	62.3552	64.8	62.3372	67.8	62.3164	70.8	62.2946	73.8	62.2706	76.8	62.2448	79.8	62.2178	82.8	62.1880	85.8	62.1572
61.9	62.3546	64.9	62.3366	67.9	62.3157	70.9	62.2938	73.9	62.2698	76.9	62.2439	79.9	62.2169	82.9	62.1870	85.9	62.1561
62.0	62.3540	65.0	62.3360	68.0	62.3150	71.0	62.2930	74.0	62.2690	77.0	62.2430	80.0	62.2160	83.0	62.1860	86.0	62.1550
62.1	62.3534	65.1	62.3353	68.1	62.3143	71.1	62.2922	74.1	62.2682	77.1	62.2421	80.1	62.2150	83.1	62.1850	86.1	62.1539
62.2	62.3528	65.2	62.3346	68.2	62.3136	71.2	62.2914	74.2	62.2674	77.2	62.2412	80.2	62.2140	83.2	62.1840	86.2	62.1528
62.3	62.3522	65.3	62.3339	68.3	62.3129	71.3	62.2906	74.3	62.2666	77.3	62.2403	80.3	62.2130	83.3	62.1830	86.3	62.1517
62.4	62.3516	65.4	62.3332	68.4	62.3122	71.4	62.2898	74.4	62.2658	77.4	62.2394	80.4	62.2120	83.4	62.1820	86.4	62.1506
62.5	62.3510	65.5	62.3325	68.5	62.3115	71.5	62.2890	74.5	62.2650	77.5	62.2385	80.5	62.2110	83.5	62.1810	86.5	62.1495
62.6	62.3504	65.6	62.3318	68.6	62.3108	71.6	62.2882	74.6	62.2642	77.6	62.2376	80.6	62.2100	83.6	62.1800	86.6	62.1484
62.7	62.3498	65.7	62.3311	68.7	62.3101	71.7	62.2874	74.7	62.2634	77.7	62.2367	80.7	62.2090	83.7	62.1790	86.7	62.1473
62.8	62.3492	65.8	62.3304	68.8	62.3094	71.8	62.2866	74.8	62.2626	77.8	62.2358	80.8	62.2080	83.8	62.1780	86.8	62.1462
62.9	62.3486	65.9	62.3297	68.9	62.3087	71.9	62.2858	74.9	62.2618	77.9	62.2349	80.9	62.2070	83.9	62.1770	86.9	62.1451